

Remarks

Applicants have reviewed the Application in light of the Office Action mailed December 1, 2005. Applicants respectfully request reconsideration and allowance of all pending claims.

Claims 1-16 Comply with the Enablement Requirement

The Examiner rejects Claims 1-16 under 35 U.S.C. § 112 para. 1 as failing to comply with the enablement requirement. Specifically, the Examiner states, "In the specification, applicants do not describe or explain a 'third engine.'" Applicants respectfully disagree with the Examiner.

FIGURE 1 illustrates an example system 10 for scheduling events in an SAT solver. (Specification, Page 5, Lines 2-3). System 10 includes a computer system 12, an SAT solver 14, and SAT data 16. (Specification, Page 5, Lines 3-4). SAT solver 14 includes a first-order metrics engine 18, a second-order metrics engine 20, a restart engine 22, and an ordering engine 24. (Specification, Page 5, Lines 18-19).

According to the Specification, restart engine 22 may, according to one or more criteria, restart a search for a solution to an SAT problem. (Specification, Page 10, Lines 10-11). In particular embodiments, restart engine 22 may restart a search according to one or more CDRs. (Specification, Page 10, Lines 11-12). As an example and not by way of limitation, during a first search for a valid solution to an SAT problem, first-order metrics engine 18 may collect first-order statistics on the first search indicating number of conflicts and number of decisions since a start of the first search. (Specification, Page 10, Lines 12-15). As first-order metrics engine 18 collects these statistics, second-order metrics engine 20 may derive, on an on-going basis, a CDR from the number conflicts and the number of decisions, as described above. (Specification, Page 10, Lines 15-18). The CDR may change during the first search as SAT solver 14 identifies conflicts and makes decisions. (Specification, Page 10, Lines 18-19). Restart engine 22 may monitor the CDR and, if the

CDR reaches a certain value, cause SAT solver 14 to abandon the first search and start a second search for a valid solution to the SAT problem. (Specification, Page 10, Lines 19-21).

According to the Specification, ordering engine 24 may determine a variable order for enumerating solutions to an SAT problem. (Specification, Page 11, Lines 16-17). In addition, ordering engine 24 may, according to one or more criteria, abandon a first variable order for enumerating solutions to an SAT problem and determine a second variable order for enumerating solutions to the SAT problem. (Specification, Page 11, Lines 17-19). In particular embodiments, ordering engine 24 may reorder variables for enumerating solutions to an SAT problem according to one or more CDRs. (Specification, Page 11, Lines 20-21). As an example and not by way of limitation, during a search for a valid solution to an SAT problem, ordering engine 24 may determine a first variable order for enumerating solutions to the SAT problem. (Specification, Page 11, Lines 21-24). As SAT solver 14 enumerates solutions to the SAT problem according to the first variable order and determines whether the solutions are valid, first-order metrics engine 18 may collect first-order statistics on the search indicating number of conflicts and number of decisions since the variable ordering. (Specification, Page 11, Lines 24-27). As first-order metrics engine 18 collects these statistics, second-order metrics engine 20 may derive, on an on-going basis, a CDR from the number conflicts and the number of decisions, as described above. (Specification, Page 11, Lines 27-30). The CDR may change during the first search as SAT solver 14 identifies conflicts and makes decisions. (Specification, Page 11, Lines 30-31). Ordering engine 24 may monitor the CDR and, if the CDR reaches a certain value, abandon the first variable order and determine a second variable order for enumerating solutions to the SAT problem. (Specification, Page 11, Lines 31-33).

Moreover, FIGURE 2 illustrates an example method for scheduling events in SAT solver 14. (FIGURE 2; Specification, Page 12, Lines 24-25). At step 100, SAT solver 14 starts a first search for a valid solution to an SAT problem. (FIGURE 2; Specification, Page 12, Lines 25-26). At step 102, as SAT solver 14 executes the first search, first-order metrics engine 18 collects first-order statistics on the first search that indicate number of conflicts and

number of decisions since SAT solver 14 started the first search. (FIGURE 2; Specification, Page 12, Lines 26-28). At step 104, second-order metrics engine 20 derives a CDR from these first-order statistics. (FIGURE 2; Specification, Page 12, Lines 28-29). At step 106, restart engine 22 monitors the CDR. (FIGURE 2; Specification, Page 12, Line 30). At step 108, if the CDR reaches a certain value, restart engine 22 causes SAT solver 14 to abandon the first search and start a second search for a valid solution to the SAT problem, at which point the method ends. (FIGURE 2; Specification, Page 12, Lines 30-33). The certain value may be a predetermined value and may correspond to an unacceptable level of inefficiency in a search for a valid solution to an SAT problem. (Specification, Page 12, Lines 33-35). The method illustrated in FIGURE 2 may be repeated as SAT solver 14 searches for a valid solution to the SAT problem. (Specification, Page 12, Lines 35-36).

Furthermore, FIGURE 3 illustrates another example method for scheduling events in SAT solver 14. (FIGURE 3; Specification, Page 13, Lines 4-5). At step 200, during a search for a valid solution to an SAT problem, ordering engine 24 determines a first variable order for enumerating solutions to the SAT problem. (FIGURE 3; Specification, Page 13, Lines 5-7). At step 202, SAT solver 14 enumerates solutions to the SAT problem according to the first variable order and determines whether the solutions are valid. (FIGURE 3; Specification, Page 13, Lines 7-8). At step 204, as SAT solver 14 enumerates solutions to the SAT problem and determines whether the solutions are valid, first-order metrics engine 18 collects first-order statistics on the search indicating number of conflicts and number of decisions since the variable ordering. (FIGURE 3; Specification, Page 13, Lines 9-12). At step 206, second-order metrics engine 20 derives a CDR from these first-order statistics. (FIGURE 3; Specification, Page 13, Lines 12-13). At step 208, ordering engine 24 monitors the CDR. (FIGURE 3; Specification, Page 13, Lines 13-14). At step 210, if the CDR reaches a certain value, ordering engine 24 abandons the first variable order and determines a second variable order for enumerating solutions to the SAT problem. (FIGURE 3; Specification, Page 13, Lines 14-16). The certain value may be a predetermined value and may correspond to an unacceptable level of inefficiency in a search for a valid solution to an SAT problem. (Specification, Page 13, Lines 16-18). At step 212, SAT solver 14 enumerates solutions according to the second variable order, at which point the method ends. (FIGURE 3;

Specification, Page 13, Lines 18-19). The method illustrated in FIGURE 3 may be repeated as SAT solver 14 searches for a valid solution to the SAT problem. (Specification, Page 13, Lines 19-21).

For at least these reasons, the Specification and the Drawings describe and illustrate, by way of example and not by way of limitation, “a third engine operable to schedule events in the search according to one or more of the second-order statistics,” as recited in independent Claim 1, and “scheduling events in the search according to one or more of the second-order statistics,” as recited in independent Claim 9. Applicants respectfully request reconsideration and allowance of independent Claims 1 and 9 and all their dependent claims.

The Examiner further states, “For examination purposes, third engine is interpreted as a method for pre-determining an order for watched literal selection.” Applicants take no position at this time regarding whether *a third engine operable to schedule events in the search according to one or more of the second-order statistics*, as recited in independent Claim 1, can be properly “interpreted as a method for pre-determining an order for watched literal selection.” Similarly, Applicants take no position at this time regarding whether *scheduling events in the search according to one or more of the second-order statistics*, as recited in independent Claim 9, can be properly interpreted as “pre-determining an order for watched literal selection.”

Independent Claims 1, 9, 17, and 25 are Allowable Over *Moskewicz*

The Examiner rejects independent Claims 1, 9, 17, and 25 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication No. US 2003/0084411 by Moskewicz et al. (“*Moskewicz*”).

Moskewicz merely discloses an SAT solver that arbitrarily selects literals to watch or selects the literals according to a predetermined ordering. (Abstract and Paragraph 0069). In *Moskewicz*, the SAT solver uses a Variable State Independent Decaying Sum (VSIDS)

strategy that applies low-pass filtering to statistics to satisfy conflict clauses. (Paragraphs 0108 and 0110).

In contrast, independent Claim 1 of this Application recites:

A system for scheduling events in a Boolean satisfiability (SAT) solver, the system comprising:
a first engine operable to collect one or more first-order statistics on a search for a valid solution to an SAT problem;
a second engine operable to derive one or more second-order statistics on the search from the one or more first-order statistics; and
a third engine operable to schedule events in the search according to one or more of the second-order statistics.

Independent Claims 9, 17, and 25 recite limitations similar to the limitations recited in independent Claim 1.

Moskewicz fails to disclose, teach, or suggest limitations recited in independent Claim 1. As an example, *Moskewicz* fails to disclose, teach, or suggest ***deriving one or more second-order statistics on the search from the one or more first-order statistics***, as recited in independent Claim 1. Even assuming for the sake of argument that the VSIDS strategy in *Moskewicz* applied low-pass filtering to ***one or more first-order statistics***, as recited in independent Claim 1, *Moskewicz* would still fail to disclose, teach, or suggest that such low-pass filtering results in ***one or more second-order statistics***, as recited in independent Claim 1. The low-pass filtering in *Moskewicz* merely rolls back all the counters that the VSIDS strategy has incremented.

Moreover, even assuming for the sake of argument that applying low-pass filtering to statistics in *Moskewicz* could be properly considered ***deriving one or more second-order statistics on the search from the one or more first-order statistics***, as recited in independent Claim 1, *Moskewicz* would still fail to disclose, teach, or suggest ***scheduling events in the search according to one or more of the second-order statistics***, as recited in independent Claim 1. In *Moskewicz*, the VSIDS strategy applies low-pass filtering to statistics merely to satisfy conflict clauses. Nowhere does *Moskewicz* even suggest that satisfying a conflict

clause can properly considered *scheduling events in the search*, as recited in independent Claim 1.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987); M.P.E.P. ch. 2131 (Rev. 1, Feb. 2003) (Quoting *Verdegaal Bros.*, 2 U.S.P.Q.2d at 1053). Moreover, “the identical invention must be shown in as complete detail as is contained . . . in the claim.” *Richardson v. Suzuki Motor Co.*, 9 U.S.P.Q.2d 1913, 1920 (Fed. Cir. 1989); M.P.E.P. ch. 2131 (Rev. 1, Feb. 2003) (Quoting *Richardson*, 9 U.S.P.Q.2d at 1920). Furthermore, “[t]he elements must be arranged as required by the claim.” *In re Bond*, 15 U.S.P.Q.2d 1566 (Fed. Cir. 1990); M.P.E.P. ch. 2131 (Rev. 1, Feb. 2003) (Quoting *In Re Bond*, 15 U.S.P.Q.2d at 1566). As shown above, *Moskewicz* fails to disclose, either expressly or inherently, each and every limitation recited in independent Claim 1. Therefore, *Moskewicz* does not anticipate independent Claim 1 under governing Federal Circuit case law and the M.P.E.P.

For at least the above reasons, Applicants respectfully request reconsideration and allowance of independent Claims 1, 9, 17, and 25 and all their dependent claims.

Conclusion

For at least the foregoing reasons, Applicants respectfully request allowance of all pending claims.

If a telephone conference would advance prosecution of the Application, the Examiner may call Travis W. Thomas, Attorney for Applicants, at 214.953.6676.

The Commissioner is hereby authorized to charge any fee and credit any overpayment to Deposit Account No. 02-0384 of Baker Botts LLP.

Respectfully submitted,
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A handwritten signature in black ink, appearing to be 'T-T' with a horizontal line connecting the two 'T's.

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Date: February 21, 2006

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